

## CLAIMS

### WHAT IS CLAIMED IS:

1. A cooler system, said cooler system including a heat exchanger, said heat exchanger including a case member enclosing a wet side in heat exchange relationship with a dry side, said wet and dry sides being substantially hermetically sealed from one another, said cooler system comprising:

forcing a first stream of input air through said dry side to produce a stream of cooled air;

forcing a second stream of input air through said wet side and maintaining a mass of distributed water on said wet side to produce a stream of humidified air; and

combining said streams of cooled and humidified air to produce a combined mass of air.

2. A cooler system of claim 1 including drawing at least a part of said input air for at least one of said first and second streams of air from said combined mass of air.

3. A cooler system of claim 1 wherein said combined mass of air is within the interior of a structure and said structure has an exterior, said interior has a volume and there is at least one opening having a total area of at least approximately 6 square inches substantially unobstructed to the flow of air between said interior and said exterior.

4. A cooling assembly comprising:

a heat exchanger, said heat exchanger including a case member enclosing a wet side in heat exchange relationship with a dry side, said sides being substantially hermetically sealed from one another;

a first air moving member adapted to move air through said dry side to produce a cooled stream of air;

a liquid distributing member within said wet side;

a liquid sump element associated with said wet side and adapted to receive liquid from said wet side and to make said liquid available to said liquid distributing member; and

a second air moving member adapted to move air through said wet side to produce a humidified mass of air on said wet side, said humidified mass of air including a vapor phase of said liquid.

5. A cooling assembly of claim 4 including conduit members being adapted to combine said cooled stream of air and said humidified mass of air and deliver the resultant combined streams to the interior of a structure.

6. A cooling assembly of claim 4 including a power source poweringly associated with said first and second air moving members, said power source including an ambient energy harvesting member.

7. A cooling assembly of claim 4 wherein said liquid distributing member includes a pump and a spray head.

8. A cooling assembly :

a heat exchanger, said heat exchanger including a case member including a wet side in heat exchange relationship with a dry side, said wet and dry sides being substantially hermetically sealed from one another;

a first air moving member adapted to moving air through said dry side to produce a cooled stream of air;

a humidifying system air humidifyingly associated with said wet side;

a second air moving member adapted to moving air through said wet side to produce a humidified mass of air on said wet side, said first and second air moving members requiring electrical power for their operation;

a secondary battery system, said secondary battery system being adapted to supplying all of said electrical power; and

an ambient energy harvesting system chargingly associated with said secondary battery system.

9. A cooling assembly according to claim 8 wherein said heat exchanger is configured to discharge said humidified mass of air and said cooled stream of air into the interior of a structure, and said second air moving member being adapted to drawing air from said interior.

10. A cooler installation for use in low humidity high temperature environments comprising:

a structure having an interior containing ambient air;

a tube and shell heat exchanger coolingly associated with said interior, said tube and shell heat exchanger including a case member confining a tube side and a shell side in heat exchanging relationship with one another, one said side being adapted to being dry, and the other said side being adapted to being wet;

a dry side air moving member air movingly associated with said dry side and adapted to move said ambient air through said dry side and to provide a dry side air stream;

a wet side air moving member air movingly associated with said wet side, and adapted to move said ambient air through said wet side and to provide a wet side air stream; and

a water supply system humidifyingly associated with said wet side, and said cooling installation being adapted to discharge said dry side and wet side air streams into said interior.

11. A cooling installation according to claim 10 wherein cooling installation is adapted to combine said dry side and wet side air streams before said discharge.

12. A cooling installation of claim 10 including a secondary battery system poweringly associated with said shell and tube heat exchanger, and an ambient energy harvesting system chargingly associated with a secondary battery system.

13. An air conditioning installation according to claim 10 wherein said cooling installation is adapted to cooling said ambient air on both said dry and wet sides.

14. An air conditioning installation according to claim 10 wherein said tube side is substantially hermetically sealed from said shell side, and said tube and shell heat exchanger is adapted to allowing heat to flow from said dry side to said wet side.

15. A process of air conditioning the interior of a structure, said structure being located within an exterior environment, said process comprising:

selecting a time when said exterior environment exhibits a temperature in excess of approximately 90 degrees Fahrenheit and a relative humidity of less than approximately 40 percent;

selecting a heat exchanger including a case member having a wet side in heat exchange relationship with a dry side, said sides being substantially hermetically sealed from one another, and locating said heat exchanger in air conditioning association with said interior;

establishing a mass of distributed water on said wet side;

establishing a flow of air through said wet side in contact with said mass of distributed water, and recovering a resulting stream of moist air;

establishing a flow of air through said dry side, allowing heat to flow from said dry side to said wet side, and recovering a resulting stream of cooled air; and

discharging said stream of moist air into said interior.

16. A process of air conditioning the interior of a structure according to claim 15 including selecting a time when said exterior environment exhibits a relative humidity of less than approximately 25 percent, and establishing a relative humidity in said interior of no more than approximately 50 percent.

17. A process of air conditioning the interior of a structure according to claim 15 wherein said establishing a mass of distributed water comprises providing a body of water, moving water from said body of water to said wet side and distributing the resulting moved water within said wet side to form said mass of distributed water, and recycling said mass of distributed water to said body of water.

18. A process of air conditioning the interior of a structure according to claim 15 including selecting a time when said exterior environment exhibits a relative humidity of less than approximately 25 percent and a temperature of greater than approximately 110 degrees Fahrenheit, and allowing said process of air conditioning to establish a temperature difference of at least approximately 20 degrees Fahrenheit between said ambient air and said exterior environment.

19. A process of air conditioning the interior of a structure according to claim 15 wherein said establishing a flow of air through said wet side includes drawing air from said interior, said establishing a flow of air through said dry side includes drawing air from said interior, and discharging said stream of cooled air into said interior.

20. An air conditioning system for the interior of a structure, said air conditioning system including a heat exchanger, said heat exchanger including a shell side in heat exchanging relationship with a tube side, said air conditioning system comprising:

forcing ambient air from said interior through said tube side to produce a stream of cooled air;

forcing ambient air from said interior through said shell side and maintaining a mass of distributed water on said shell side to produce a stream of humidified air; and

allowing said streams of cooled and humidified air to combine to produce a combined mass of air in said interior.

21. An air conditioning assembly for cooling the interior of a structure, said air conditioning assembly including a heat exchanger, said heat exchanger including a wet side with a wet side inlet and a wet side outlet, and a dry side having a dry side inlet and a dry side outlet, said wet side being in heat exchanging relationship to said dry side, said air conditioning system comprising:

a wet side air moving member air movingly associated with said wet side;

a dry side air moving member air movingly associated with said dry side; and

a water source water supplyingly associated with said wet side, and said wet side outlet being configured to discharge air into said interior.

22. An air conditioning assembly of claim 21 wherein said dry side outlet is configured to discharge air into said interior.

23. An air conditioning assembly for cooling the interior of a structure, said air conditioning assembly including a heat exchanger, said heat exchanger including a wet side with a wet side inlet and a wet side outlet, and a dry side having a dry side inlet and a dry side outlet, said wet side being in heat exchanging relationship to said dry side, said air conditioning system comprising:

- a wet side air moving member air movingly associated with said wet side;
- a dry side air moving member air movingly associated with said dry side; and
- a water source water supplyingly associated with said wet side, said dry side outlet being configured to discharge air into said interior.

24. An air conditioning assembly for cooling the interior of a structure, said air conditioning assembly including a heat exchanger, said heat exchanger having a shell side with a shell side inlet and a shell side outlet, and a tube side having a tube side inlet and a tube side outlet, said shell side being in heat exchanging relationship to said tube side, said air conditioning system comprising:

- a shell side air moving member configured to move air through said shell side;
- a tube side air moving member configured to move air through said tube side;

and

- a water source air humidifyingly associated with said shell side, said shell side outlet and said tube side outlet being configured to discharge air into said interior, and said shell side inlet and said tube side inlet being configured to receive air from said interior.



25. A cooling assembly , said cooling assembly including a heat exchanger, said heat exchanger having a wet side with a wet side inlet and a wet side outlet, and a dry side having a dry side inlet and a dry side outlet, said wet side being in heat exchanging relationship to said dry side, said wet and dry sides being substantially hermetically sealed from one another, said air conditioning system comprising:

a case member enclosing said heat exchanger, said case member being thermally insulated;

a wet side air moving member air movingly associated with said wet side;

a dry side air moving member air movingly associated with said dry side; and

a water source air humidifyingly associated with said wet side, said wet side outlet and said dry side outlet being configured to discharge air into a confined space, and said wet side inlet being configured to receive air from said confined space.

26. An air conditioning system for the interior of a structure, said air conditioning system including a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side, said sides being substantially hermetically sealed from one another, said heat exchanger being enclosed in a thermally insulated case, said air conditioning system comprising:

forcing ambient air from said interior through said dry side to produce a stream of cooled air;

forcing ambient air from said interior through said wet side;

maintaining a mass of distributed water on said wet side to produce a stream of humidified air; and

allowing said streams of cooled and humidified air to combine to produce a combined mass of air in said interior.

27. A cooler system, said cooler system including a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side, said cooler system comprising:

forcing air through said dry side to produce a stream of cooled air;

forcing air from said interior through said wet side and maintaining a mass of distributed water on said wet side to produce a stream of humidified air;

allowing at least a part of said mass of distributed water to form cooled water;

and

cooling an object by placing said object in heat exchanging relationship with said cooled water.

28. An air conditioning system for the interior of a structure in which there is a mass of ambient air, said air conditioning system including a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side, said air conditioning system comprising:

forcing said ambient air through said dry side to produce a stream of cooled air;

forcing said ambient air through said wet side and maintaining a mass of distributed water on said wet side to produce a stream of humidified air;

operating said air conditioning system at a rate of water consumption that is less than approximately 10 percent that of a conventional evaporative cooler operated under substantially the same external conditions; and

allowing said streams of cooled and humidified air to produce a combined mass of air in said interior.

29. An air conditioning system of claim 28 including operating said air conditioning system at a rate of water consumption that is less than approximately 5 percent of that of a conventional evaporative cooler operated under substantially the same external conditions.

30. A cooling assembly comprising:

- a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side;
- a first air moving member adapted to moving air through said dry side to produce a cooled stream of air;
- a water supply system air humidifyingly associated with said wet side;
- a second air moving member adapted to moving air through said wet side to produce a mass of moist air on said wet side, said first and second air moving members requiring electrical power for their operation;
- a secondary battery system, said secondary battery system being adapted to supplying all of said electrical power; and
- a solar energy harvesting system chargingly associated with said secondary battery system.

31. An air conditioning assembly for cooling the interior of a structure comprising:

a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side;

a first air moving member adapted to moving air through said dry side to produce a cooled stream of air;

a water supply system air humidifyingly associated with said wet side;

a second air moving member adapted to moving air through said wet side to produce a mass of moist air on said wet side, said first and second air moving members and said water supply system all requiring electrical power for their operation, said air conditioning assembly being adapted to discharging said mass of moist air into said interior, and said second air moving member being adapted to drawing air from said interior;

a secondary battery system, said secondary battery system being adapted to supplying all of said electrical power; and

an ambient energy harvesting system chargingly associated with said secondary battery system.

32. An air conditioning assembly of claim 31 wherein said ambient energy harvesting system comprises a solar cell.

33. An air conditioning assembly of claim 31 wherein said ambient energy harvesting system comprises a wind turbine.

34. An air conditioning system for the interior of a structure in which there is a mass of ambient air, said air conditioning system including a heat exchanger, said heat exchanger including a wet side in heat exchanging relationship with a dry side, said air conditioning system comprising:

forcing said ambient air through said dry side to produce a stream of cooled air;

forcing said ambient air through said wet side and maintaining a mass of distributed liquid water on said wet side to produce a stream of humidified air;

discharging said stream of humidified air into said ambient air;

operating said air conditioning system at a rate of water consumption that is less than approximately 10 percent that of a conventional evaporative cooler operated under substantially the same external conditions; and

harvesting ambient energy and operating said air conditioning system solely on the resulting harvested ambient energy.

35. An air conditioning system of claim 34 wherein a secondary battery system is poweringly associated with said heat exchanger and said harvested ambient energy is applied to charging said secondary battery system.

36. A process of air conditioning the interior of a structure, said structure being located within an exterior environment, said process comprising:

selecting a time when said exterior environment exhibits a temperature in excess of approximately 100 degrees Fahrenheit and a relative humidity of less than approximately 30 percent;

selecting a heat exchanger having a wet side in heat exchanging relationship with a dry side, and locating said heat exchanger in air conditioning association with said interior;

establishing a mass of air humidifying distributed water on said wet side;

establishing a flow of air through said wet side in contact with said mass of distributed water, and recovering a resulting stream of moist air;

establishing a flow of air through said dry side and recovering a resulting stream of cooled air;

harvesting ambient energy and applying the resultant harvested energy to establishing said mass and said flows;

operating said air conditioning system at a rate of water consumption that is less than approximately 10 percent that of a conventional evaporative cooler operated under substantially the same external conditions; and

maintaining a temperature in said interior of less than approximately 85 degrees Fahrenheit and a relative humidity of no more than approximately twice that of said exterior environment.

37. A process of claim 36 selecting a time when said exterior environment exhibits a temperature in excess of 110 degrees Fahrenheit and a relative humidity of less than about 25 percent.

38. A process of claim 36 including selecting a time when said exterior environment exhibits a temperature in excess of 110 degrees Fahrenheit and a relative humidity of less than about 25 percent, and operating said air conditioning system at a rate of water consumption that is less than approximately 5 percent that of a conventional evaporative cooler operated under substantially the same external conditions.

39. A process of claim 36 including combining said streams of cooled and moist air to produce a combined mass of air in said interior.

40. An air conditioning system for the interior of a structure, said air conditioning system including a heat exchanger, said heat exchanger having a shell side and a tube side in heat exchanging relationship with one another, said air conditioning system comprising:

forcing ambient air through said tube side to produce a stream of cooled air;  
forcing ambient air through said shell side and maintaining a mass of finely divided water on said shell side to produce a stream of humidified ambient air; and  
combining said streams of cooled and humidified air to produce a combined mass of air in said interior.

41. An air conditioning system of claim 40 including drawing said ambient air from said interior.

42. An air conditioning assembly for cooling the interior of a structure comprising:

a heat exchanger, said heat exchanger having a shell side and a tube side;

a first air moving member adapted to move air through said tube side to produce a cooled stream of air;

a liquid dispensing member on said shell side adapted to distribute liquid substantially throughout said shell side;

a liquid sump element associated with said shell side and adapted to receive said liquid from said shell side and to make said liquid available to said liquid dispensing member;

a second air moving member adapted to move air through said shell side to produce a turbulent mass of air on said shell side, said turbulent mass of air including a vapor phase of said liquid; and

conduit members adapted to convey said cooled stream of air and said turbulent mass of air from said heat exchanger to said interior.

43. An air conditioning assembly of claim 42 including a power source, said power source including solar panels.



44. An air conditioning assembly for cooling the interior of a structure comprising:

a heat exchanger, said heat exchanger having a shell side and a tube side;

a first air moving member adapted to moving air through said tube side to produce a cooled stream of air;

a liquid dispensing member on said shell side adapted to distributing liquid substantially throughout said shell side;

a liquid sump element associated with said shell side and adapted to receiving said liquid from said shell side and to making said liquid available to said liquid dispensing member;

a second air moving member adapted to moving air through said shell side to produce a turbulent mass of air on said shell side, said turbulent mass of air including a vapor phase of said liquid, said first and second air moving members and said liquid dispensing member all requiring electrical power for their operation;

conduit members adapted to conveying said stream of cooled air and said turbulent mass of air to said interior;

a secondary battery system, said secondary battery system being adapted to supplying all of said electrical power; and

a solar cell system chargingly associated with said secondary battery system.

45. An air conditioning installation for use in low humidity high temperature environments comprising:

a structure having an interior containing ambient air;

a tube and shell heat exchanger air conditioningly associated with said interior, said tube and shell heat exchanger including a tube side and a shell side, said tube side being adapted to being dry, and said shell side being adapted to being wet;

a tube side air moving member air movingly associated with said tube side and adapted to move said ambient air through said tube side and to provide a tube side air stream;

a shell side air moving member air movingly associated with said shell side, and adapted to move said ambient air through said shell side and to provide a shell side air stream;

a water supply system wettingly associated with said shell side, said water supply system including a sump, a water emitting element on said shell side, and a water pump member circulatingly positioned between said sump and said water emitting element, said water supply system being adapted to maintain said shell side wet with water; and

an air conduit system air receivingly associated with said tube and shell sides and adapted to discharge said tube side and shell side air streams into said interiors.

46. A process of air conditioning the interior of a structure containing ambient air, said structure being located within an exterior environment, said process comprising:

selecting a time when said exterior environment exhibits a temperature in excess of approximately 90 degrees Fahrenheit and a relative humidity of less than approximately 40 percent;

selecting a tube and shell heat exchanger having a wet shell side and a dry tube side, and locating said tube and shell heat exchanger in air conditioning association with said interior;

establishing a mass of dispersed water on said shells side;

establishing a flow of said ambient air through said shell side in contact with said mass of dispersed water, and recovering a resulting stream of moist air;

establishing a flow of said ambient air through said tube side and recovering a resulting stream of cooled air; and

combining said streams of moist and cooled air and discharging a resulting stream of combined air into said interior.